# Rodagon-G

## For extreme enlargements the most important thing is focus

Rodenstock can offer different enlarging lens types for different applications and quality demands: The current range begins with the favorably priced three-element Rogonar lens, moves on to include the high-quality four-element Rogonar-S and ends with the top, six-element lenses Rodagon, Rodagon-WA (with enlarged image angle) and the apochromatic Apo-Rodagon-N with six or seven lens elements depending on the focal length. One particularly special product in the range is the Rodagon-G described here. This special lens for picture sizes from the poster format to multi-strip giant enlargements has six elements and has been optimized for the very high enlarging scales. The Rodagon-G comes in focal lengths from 50 mm to 480 mm for film sizes from 35 mm to sheet film 10x12"/24x30 cm and is primarily used in horizontal enlargers.

Note: Separate product information leaflets are available for the enlarging lenses Rodagon, Rodagon-WA and Apo-Rodagon-N which give detailed information on the special features of these lens types together with all technical data.

| **Conventional film sizes for horizontal enlargers** | | |
|---|---|---|
| Size / Film designation | Format size* | Diagonal* |
| Full frame "135" | 24×36 mm | 43.3 mm |
| 4.5×6 cm / Roll film "120" and "220" | 42×56 mm | 70.0 mm |
| 6×6 cm / Roll film "120" and "220" | 56×56 mm | 79.2 mm |
| 6×7 cm / Roll film "120" and "220" | 56×68 mm | 88.1 mm |
| 6×9 cm / Roll film "120" and "220" | 56×81 mm | 98.5 mm |
| 9×12 cm / Sheet film | 83×114 mm | 141.0 mm |
| 4×5" / Sheet film | 96×120 mm | 153.7 mm |
| 13×18 cm / Sheet film | 122×171 mm | 210.1 mm |
| 5×7" / Sheet film | 121×170 mm | 208.7 mm |
| 18×24 cm / Sheet film | 171×231 mm | 287.4 mm |
| 8×10" / Sheet film | 194×245 mm | 312.5 mm |
| 24×30 cm / Sheet film | 230×290 mm | 370.0 mm |
| 10×12" / Sheet film | 245×295 mm | 383.5 mm |

* The masks of the printers and their diagonals are slightly smaller.

### Technical Data

| Nominal focal length | Maximum aperture | max. recommended film size | recommended scale (optimal) | Optimum reproduction scale | Mount-size | lowest aperture | pre-selection aperture | click-stop disable | illuminated stop display |
|---|---|---|---|---|---|---|---|---|---|
| **Rodagon-G** | | | | | | | | | |
| 50 mm | f/2.8 | 35 mm film-format | 15× ... 50× | 25× | 0 | 16 | ● | ● | ● |
| 105 mm | f/5.6 | 6×9 cm | 10× ... 40× | 20× | 1 | 45 | – | – | ● |
| 150 mm | f/5.6 | 9×12 cm / 4×5" | 10× ... 40× | 20× | 1 | 45 | – | – | ● |
| 210 mm | f/5.6 | 13×18 cm / 5×7" | 8× ... 30× | 20× | 2 | 45 | – | – | ● |
| 240 mm | f/5.6 | 13×18 cm / 5×7" | 8× ... 30× | 20× | 3 | 45 | – | – | ● |
| 300 mm | f/5.6 | 18×24 cm / 8×10" | 8× ... 30× | 20× | 3 | 45 | – | – | ● |
| 360 mm | f/6.8 | 18×24 cm / 8×10" | 8× ... 30× | 20× | 3 | 45 | – | – | ● |
| 480 mm | f/8.4 | 24×30 cm / 10×12" | 8× ... 30× | 20× | 3 | 64 | – | – | ● |

### Top performance thanks to the optimization of the image reproduction quality for scales of around 20x

As the size of the enlargement increases, the performance limits of the enlarging lens become increasingly visible. In particular, very high demands are made on the resolution and the contrast in finely structured details. The maximum height of conventional enlargers alone means that standard enlarging lenses are designed for scale ranges restricted to around 10x (sheet film) or 20x (35 mm). This is the reason why Rodenstock developed the Rodagon-G, optimized for scales of around 20x to 25x with a recommended scale range depending on the film size and focal length of up to 50x.

The scale range of the Rodagon-G was chosen to link up with the other Rodagon types without any gap: The lower limit given in the above table shows the scale from which the Rodagon-G will show its superior quality to high-quality enlarging lenses with conventional scales. This superiority is visible primarily in the focus and the even better correction of distortion.

In addition, the Rodagon-G features very high uniformity of performance in its recommended scale range over the whole negative area from the center to

## Mechanical and optical Data

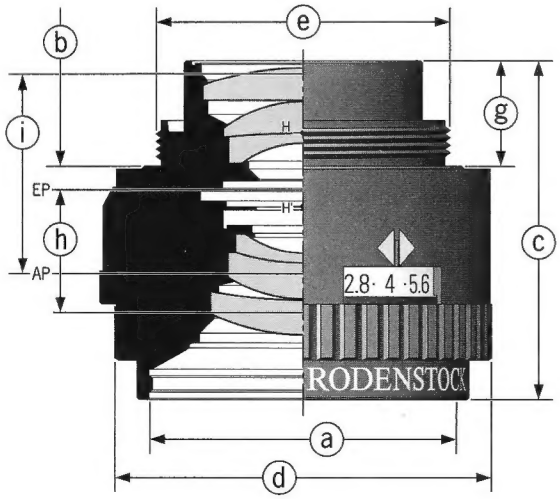
| filter thread [mm] | flange focal length at ∞ | overall length | maximum lens dia. ∅ | screw thread [mm] | contact area to rear edge | Effective focal length ±0.5% | Principle Point distance HH | Entrance pupil ∅ (EnP) | Exit pupil ∅ (ExP) | EnP-ExP ratio | Front vertex to EnP | ExP to back vertex |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | b | c | d | e | g | | | | | | h | i |
| | | | | | | | | | | | | |
| M 40.5×0.5 | 47.0 mm | 45.0 mm | 50.0 mm * | M 39×1/26" | 14.0 mm | 52.1 mm | - 9.72 mm | 17.7 mm | 20.8 mm | 0.85 | 19.2 mm | 27.3 mm |
| M 40.5×0.5 | 100.3 mm | 38.0 mm | 60.0 mm | M 50×0.75 | 14.3 mm | 104.3 mm | - 2.49 mm | 18.0 mm | 18.0 mm | 1.00 | 17.6 mm | 17.5 mm |
| M 49×0.75 | 141.8 mm | 50.6 mm | 60.0 mm | M 50×0.75 | 20.5 mm | 146.8 mm | - 3.50 mm | 25.3 mm | 25.3 mm | 1.00 | 24.8 mm | 24.5 mm |
| M [illegible]0.75 | 179.5 mm | 65.9 mm | 74.5 mm | M 72×1 | 8.5 mm | 207.2 mm | - 4.93 mm | 35.7 mm | 35.7 mm | 1.00 | 35.0 mm | 34.6 mm |
| M [illegible]0.75 | 230.6 mm | 76.9 mm | 80.0 mm | M 72×1 | 32.2 mm | 240.2 mm | - 5.71 mm | 41.4 mm | 41.4 mm | 1.00 | 40.5 mm | 40.1 mm |
| M 86×1 | 253.3 mm | 93.5 mm | 93.5 mm | M 90×1 | 11.5 mm | 292.2 mm | - 6.96 mm | 50.0 mm | 50.0 mm | 1.00 | 49.4 mm | 48.8 mm |
| M 105×1 | 304.2 mm | 116.5 mm | 110.0 mm | M 90×1 | 12.2 mm | 347.6 mm | - 4.77 mm | 50.5 mm | 49.4 mm | 1.02 | 72.4 mm | 46.8 mm |
| M 112×1.5 | 412.0 mm | 146.8 mm | 115.0 mm | M 110×1 | 17.7 mm | 467.4 mm | - 7.65 mm | 55.6 mm | 54.8 mm | 1.02 | 87.7 mm | 64.4 mm |

* Switch lever for half-stop clicks and infinite setting protrudes 2 mm over the mount with a diameter of 50 mm.

the furthermost corners. The contrast is already very high at maximum aperture in the area around the picture center used for focusing so that the focusing process is fast and exact. This is particularly important for very large scales as these make focusing much more difficult due to the lower projection illumination. The optimum working aperture is reached by stopping down by only 2 f/numbers. This means that even at the largest scales the exposure times are still so short that the Schwarzschild effect is not a problem.

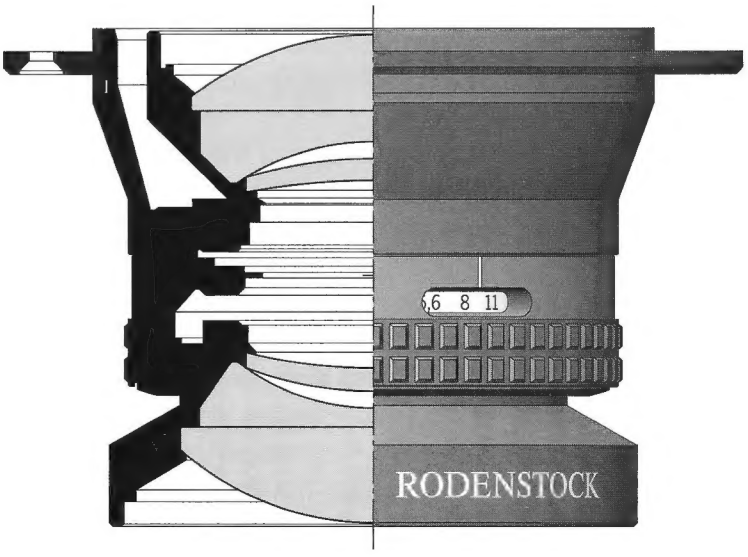
Another strength is the very favorable course of light fall-off towards the edge of the picture. This is only

### Lens sections at a scale of 1:1




Rodagon-G 50 mm f/2.8

6 elements/4 groups
Mount-size 0




Rodagon-G 210 mm f/5.6

6 elements/4 groups
Mount-size 2

possible because the effective image angle of the Rodagon-G is larger than required for the maximum format. This means that the light fall-off is lower than usual even at the largest reproduction scales – when the image angle is utilized the most at a given film size. This is also an important plus because of the Schwarzschild effect (color shift at the edges) resulting from the lower illumination at such large reproduction scales.

The quality of the mount mechanics is just as good as that of the optics. For greater comfort the 50 mm lens has a presetting ring and a diaphragm adjustment that can be switched between click-stops at half numbers and infinite adjustment. All Rodagon-G lenses have an aperture display lit by the light of the enlarger head.

## Modulation transfer function (MTF) as a demonstration of quality

The high imaging quality of Rodenstock Rodagon-G lenses is documented in the MTF curves and diagrams for relative light drop-off, distortion and longitudinal chromatic aberration on the following data sheet pages.

The MTF curves show the contrast of fine grating structures in dependence on the image height (0 = center, maximal value = image circle circumference). The "sagittal" curves apply to structures extending radially from the image circle center and the dotted "meridional" curves to structures running tangentially or in circular form around the image circle center. The topmost curve pair applies to the lowest spatial frequency (lp/mm = line pairs per millimeter), the bottommost to the highest. The film format-dependent spatial frequencies are given over the MTF diagram (e.g. for 35 mm 5 lp/mm to 40 lp/mm).

The top diagram applies to the open diaphragm, the bottom for the recommended working aperture (stopped down two numbers). The higher the curves are and the less they fall off towards the edge, the better it is. While diffraction sets physical limits to the imaging quality, the Rodagon-G comes incredibly close to these limits.

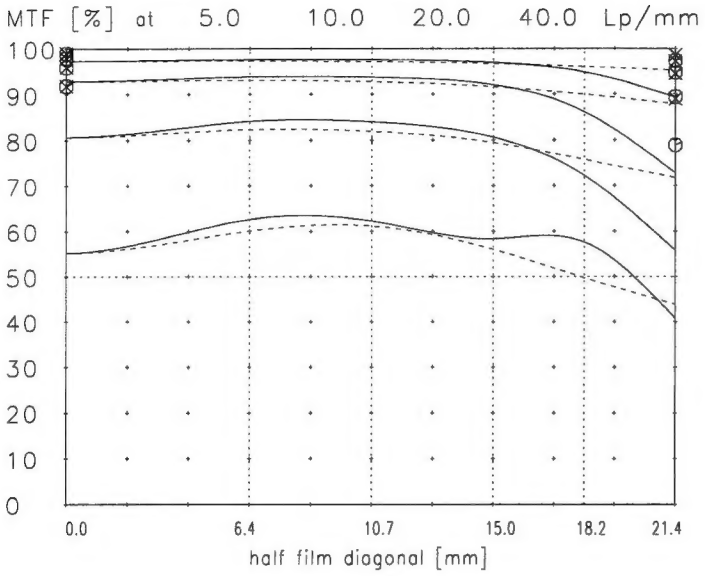
The diagram with the relative light drop-off shows how uniformly the image field is illuminated. With an open diaphragm, the edge brightness due to mount vignetting falls somewhat; stopping down by one number eliminates vignetting almost completely, and stopping down by two numbers will put the brightness right at the physical limit (curve "$1\text{-}\cos^4$").

Distortion varies with the imaging scale. With the Rodagon-G it is optimized for the much larger scales of the horizontal enlarger when compared to conventional enlarging lenses so that even in the most unfavorable case it remains so low that it can be neglected to all practical intent in imagewise photography. Because the distortion of Rodagon-G enlarging lenses is contrary to that of the Rodenstock Apo-Sironar taking lenses for roll and sheet film due to the "reversed" ray path, shots taken with these taking lenses give the ideal case of enlargement with practically no distortion whatsoever.

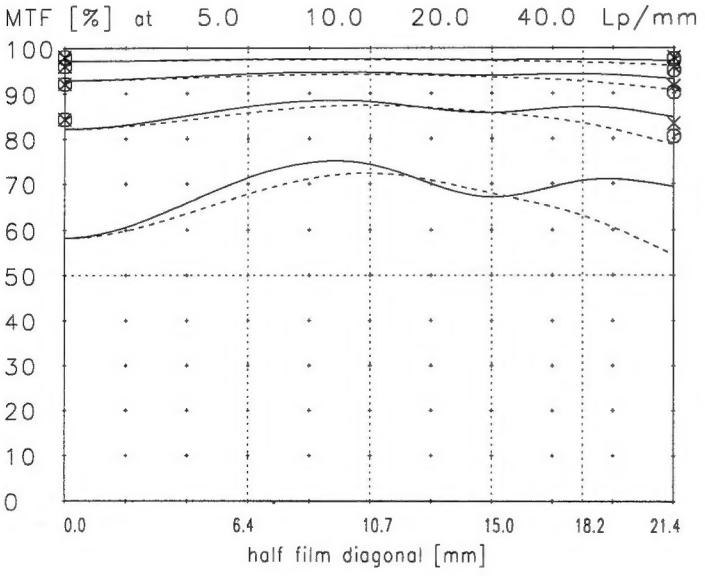
The longitudinal chromatic deviation shows the different position of the focal point for different wavelengths (colors). When enlarging black-and-white prints, only the left third of the diagram is of relevance because b/w papers are only sensitive to green and possibly slightly to green; for color enlargers the whole area is important. In this regard, too, the Rodagon-G lenses are at the same level as the best taking lenses.

# Rodagon-G 50 mm f/2.8

MTF at ratio 25x f/ 2.8



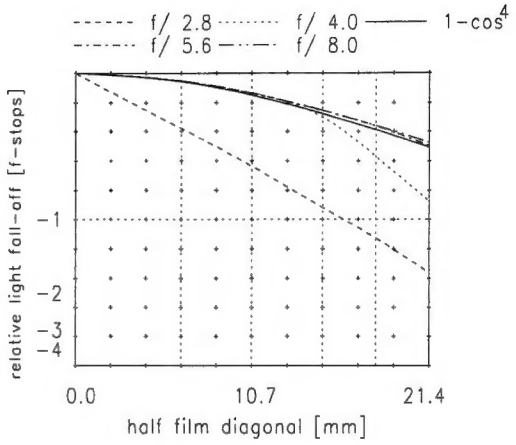

MTF at ratio 25x f/ 5.6



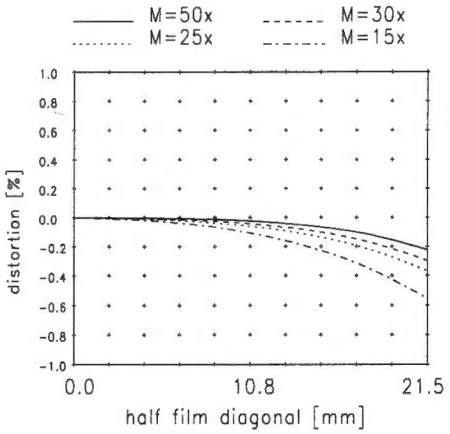

——— sagittal, × Diffraction limited value
------ meridional, ⊖ Diffraction limited value

Named frequencies [line pairs/mm] in modular transfer function (MTF) as well as diagrams of relative light fall-off, distortion and longitudinal color aberration refer to film plane.

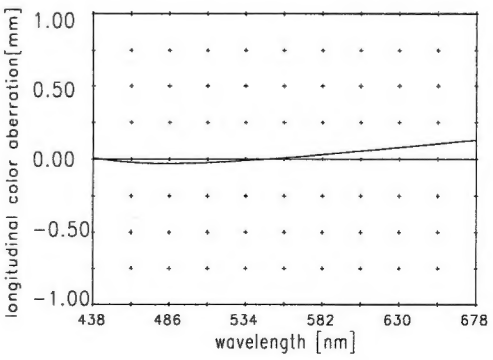
relative light fall-off at ratio 25x




Distortion at ratio 50x to 15x

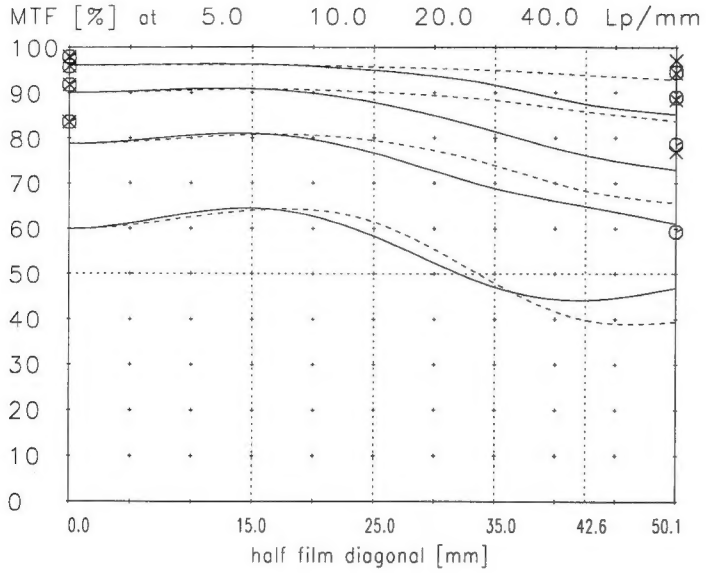



Longitudinal color aberration at ratio 25x

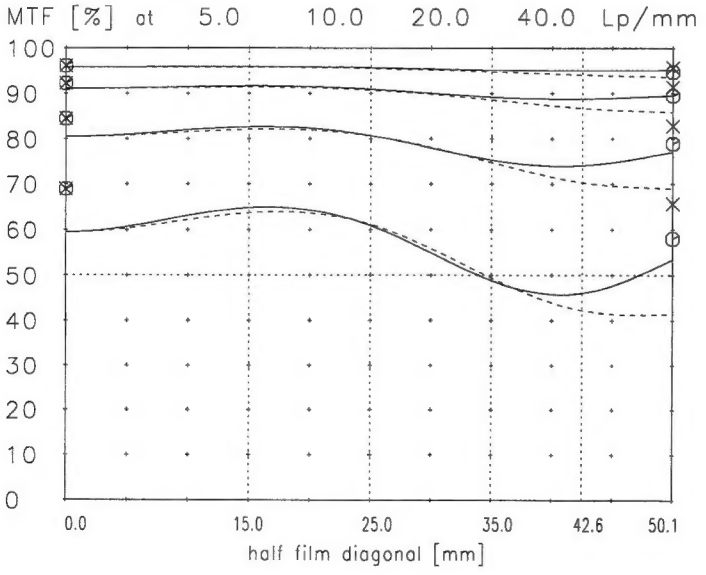


# Rodagon-G 105 mm f/5.6

MTF at ratio 20x f/ 5.6



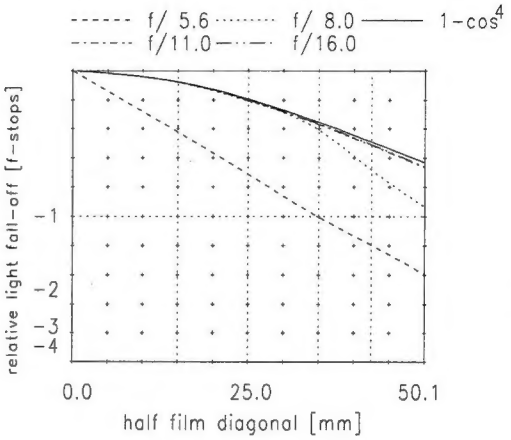

MTF at ratio 20x f/ 11



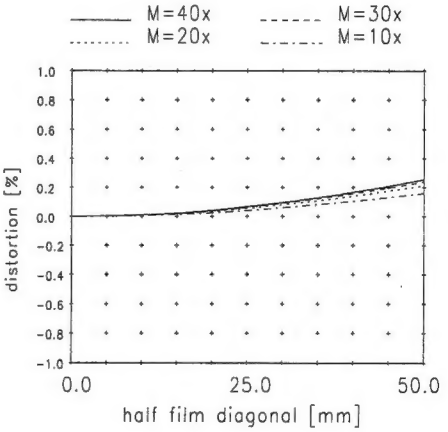

——— sagittal, × Diffraction limited value
------ meridional, ⊖ Diffraction limited value

Named frequencies [line pairs/mm] in modular transfer function (MTF) as well as diagrams of relative light fall-off, distortion and longitudinal color aberration refer to film plane.

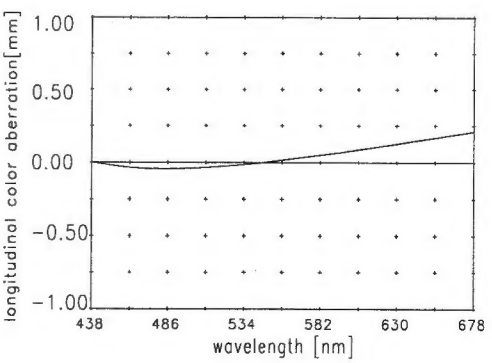
relative light fall-off at ratio 20x




Distortion at ratio 40x to 10x

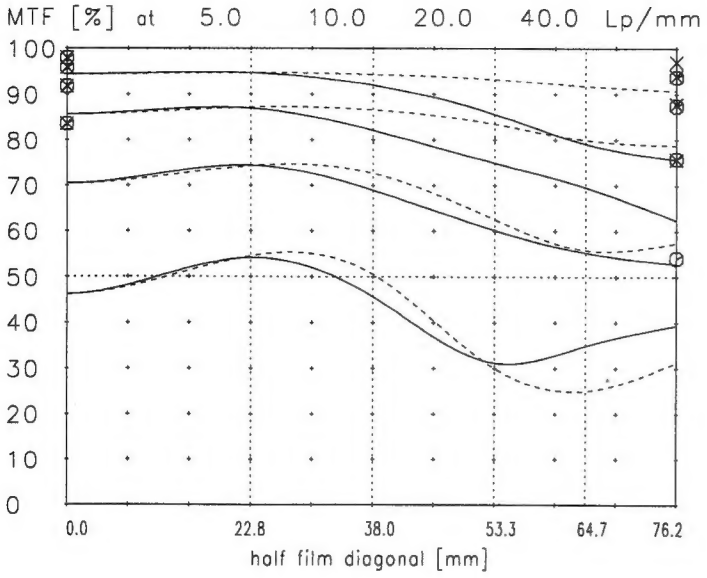



Longitudinal color aberration at ratio 20x

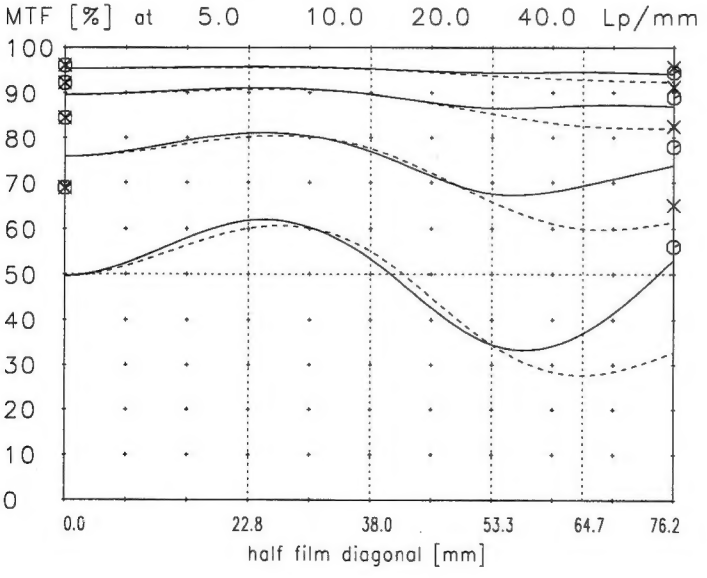


# Rodagon-G 150 mm f/5.6

MTF at ratio 20x f/ 5.6



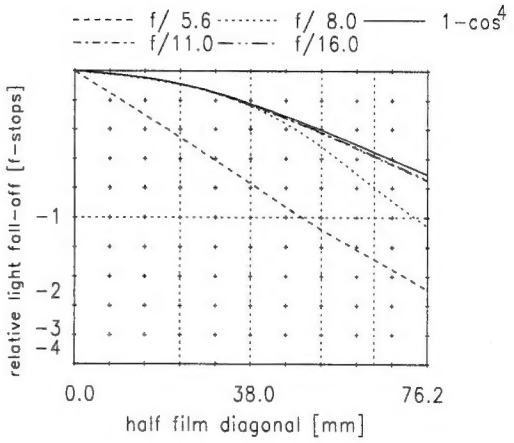

MTF at ratio 20x f/ 11



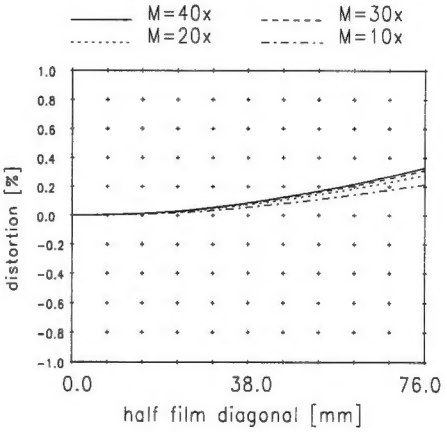

——— sagittal, × Diffraction limited value
------ meridional, ⊖ Diffraction limited value

Named frequencies [line pairs/mm] in modular transfer function (MTF) as well as diagrams of relative light fall-off, distortion and longitudinal color aberration refer to film plane.

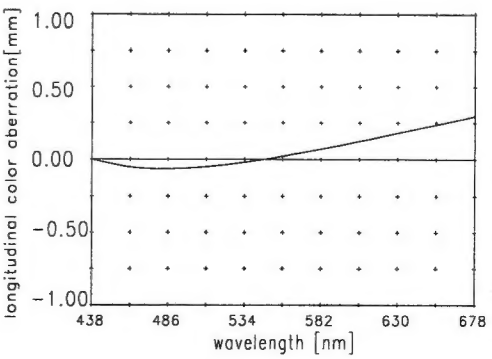
relative light fall-off at ratio 20x




Distortion at ratio 40x to 10x

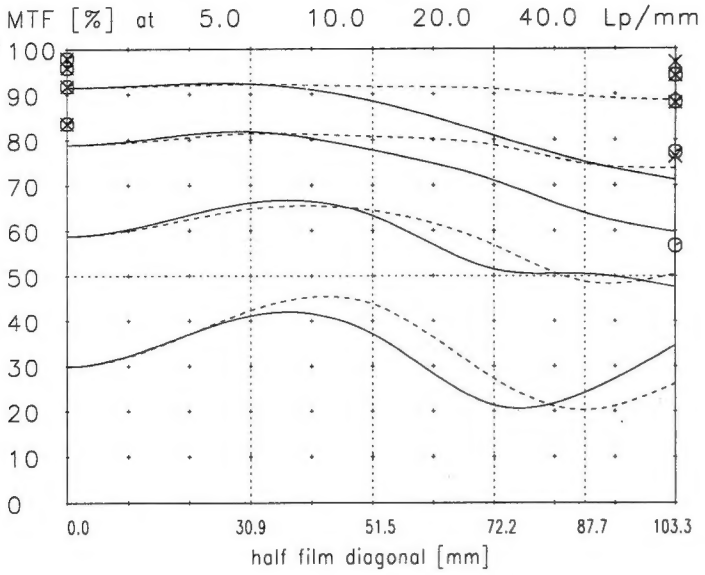



Longitudinal color aberration at ratio 20x

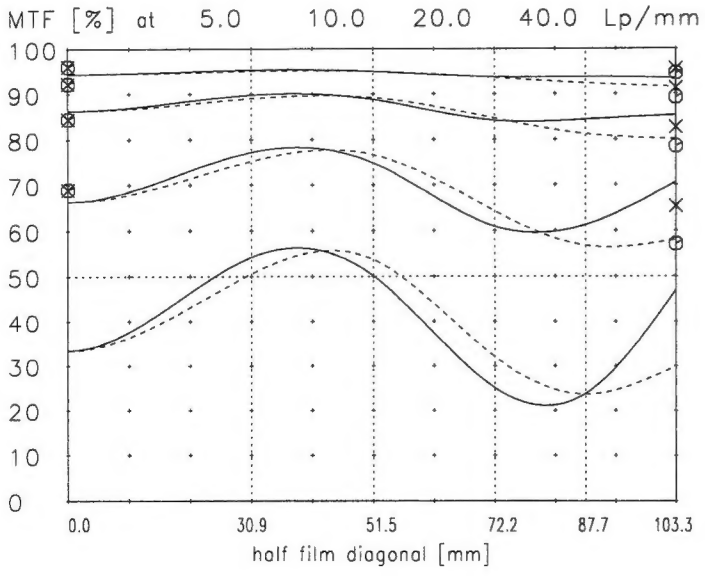


# Rodagon-G 210 mm f/5.6

MTF at ratio 20x f/ 5.6



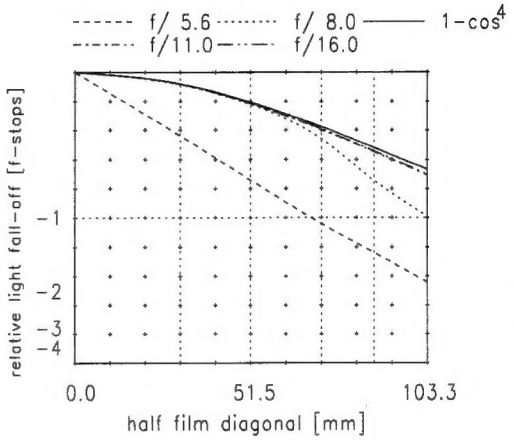

MTF at ratio 20x f/ 11



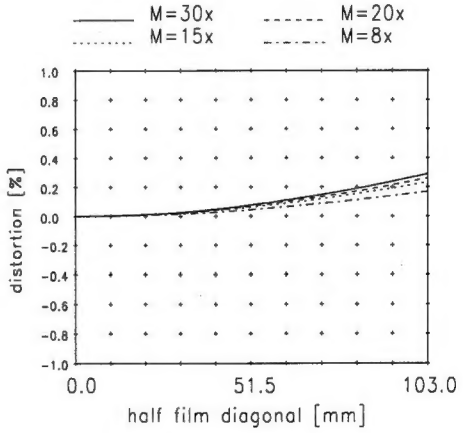

——— sagittal, × Diffraction limited value
- - - - - - meridional, ⊖ Diffraction limited value

Named frequencies [line pairs/mm] in modular transfer function (MTF) as well as diagrams of relative light fall-off, distortion and longitudinal color aberration refer to film plane.

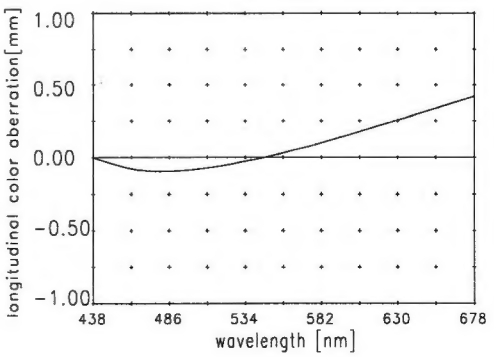
relative light fall-off at ratio 20x




Distortion at ratio 30x to 8x

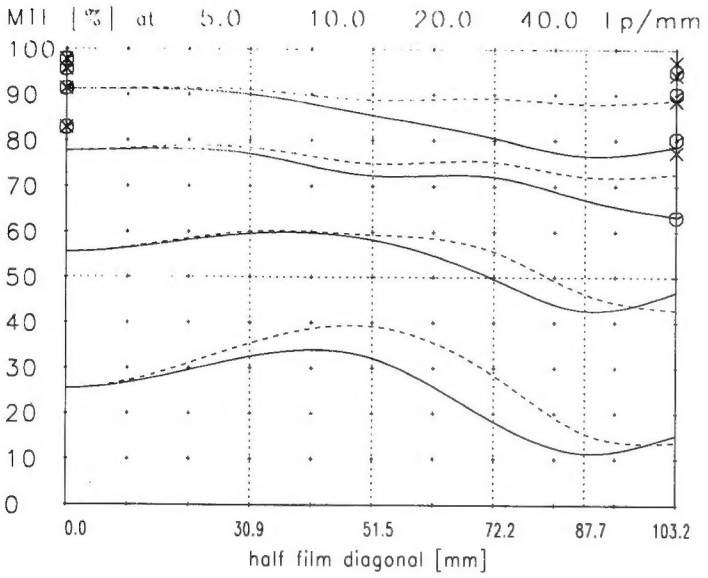



Longitudinal color aberration at ratio 20x

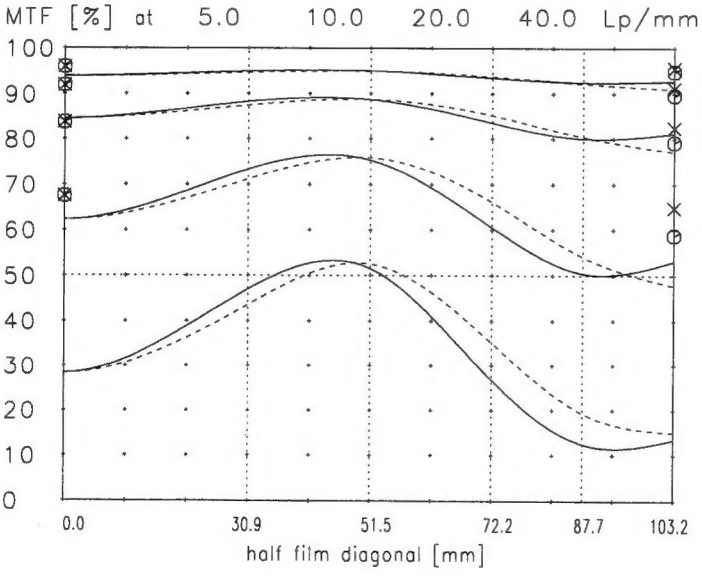


# Rodagon-G 240 mm f/5.6

MTF at ratio 20x f/ 5.6



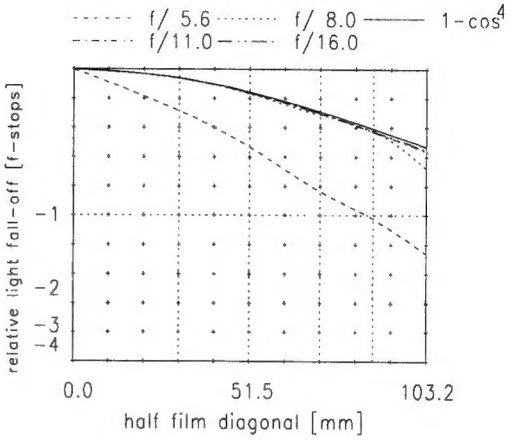

MTF at ratio 20x f/ 11



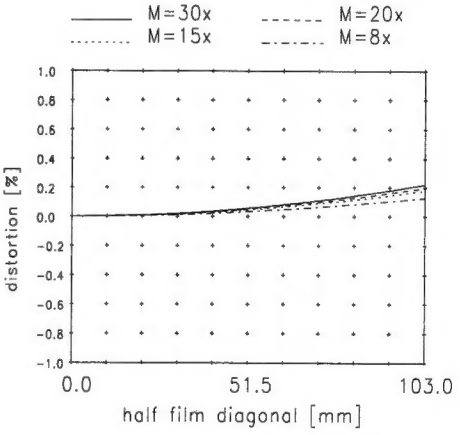

——— sagittal, × Diffraction limited value
------ meridional, ⊖ Diffraction limited value

Named frequencies [line pairs/mm] in modular transfer function (MTF) as well as diagrams of relative light fall-off, distortion and longitudinal color aberration refer to film plane.

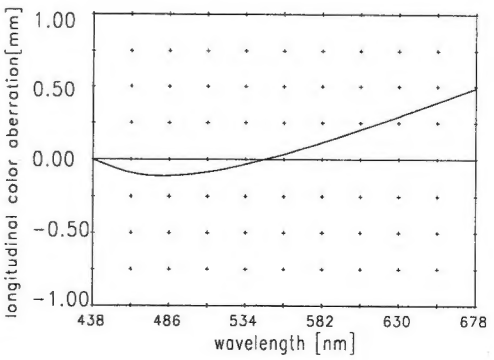
relative light fall-off at ratio 20x




Distortion at ratio 30x to 8x

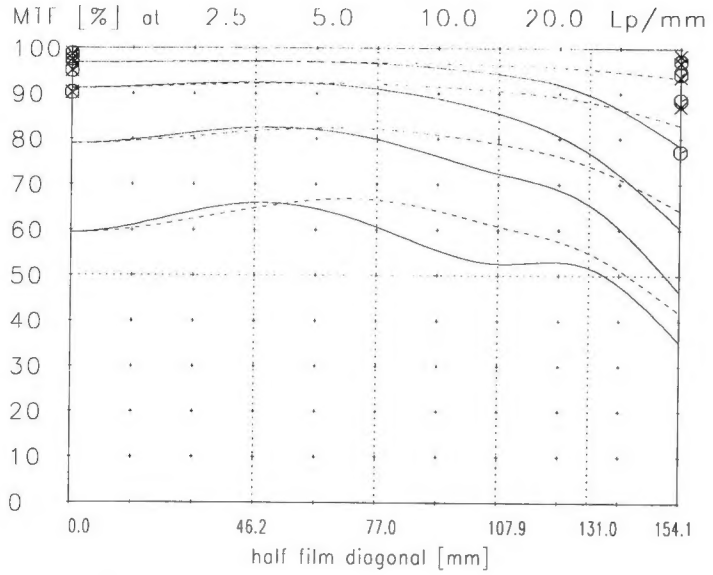



Longitudinal color aberration at ratio 20x

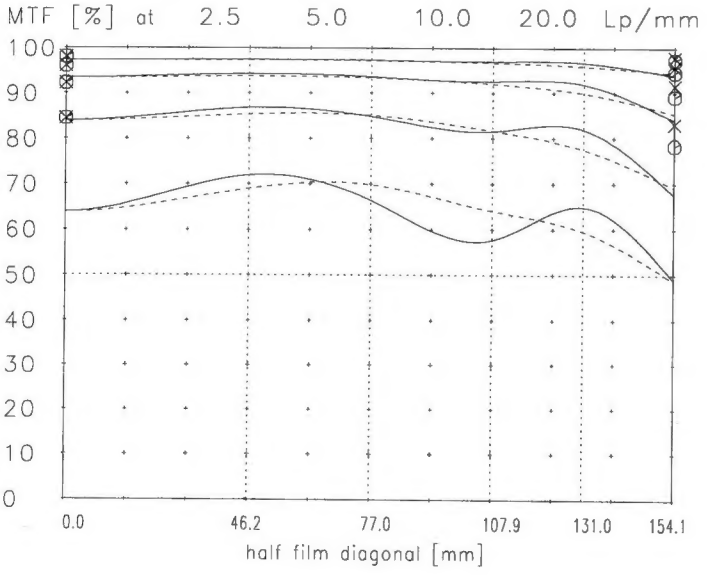


# Rodagon-G 360 mm f/6.8

MTF at ratio 20x f/ 6.8



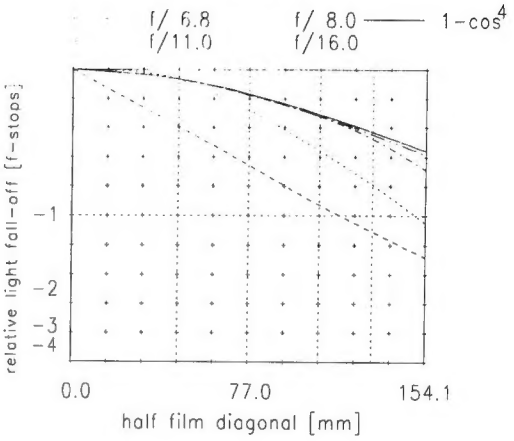

MTF at ratio 20x f/ 11



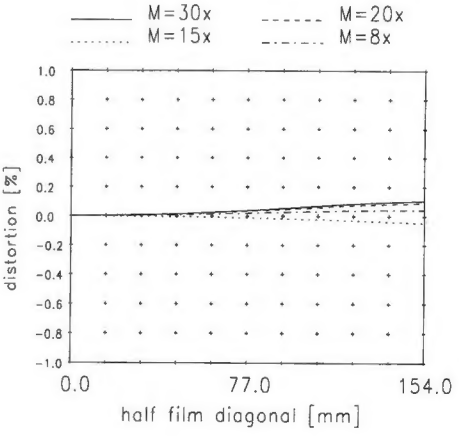

——— sagittal, × Diffraction limited value
------ meridional, ⊖ Diffraction limited value

Named frequencies [line pairs/mm] in modular transfer function (MTF) as well as diagrams of relative light fall-off, distortion and longitudinal color aberration refer to film plane.

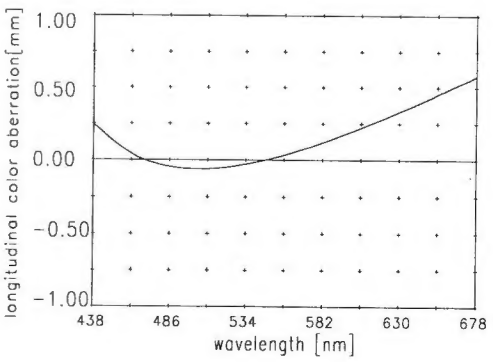
relative light fall-off at ratio 20x




Distortion at ratio 30x to 8x



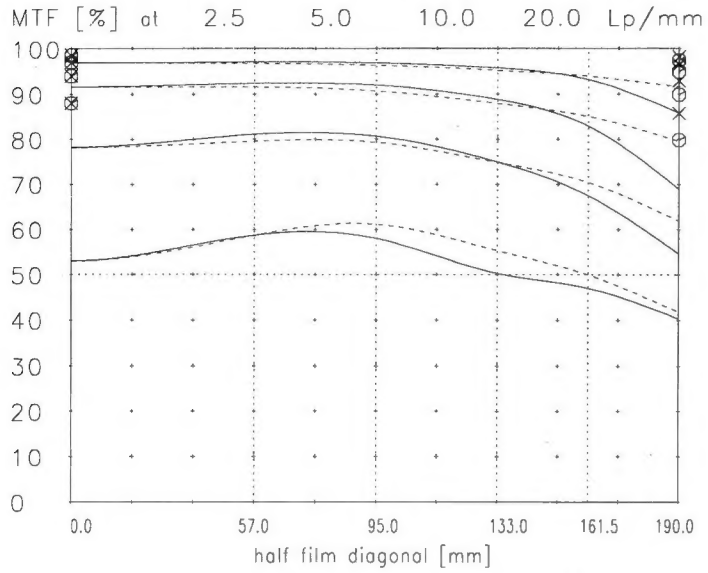

Longitudinal color aberration at ratio 20x



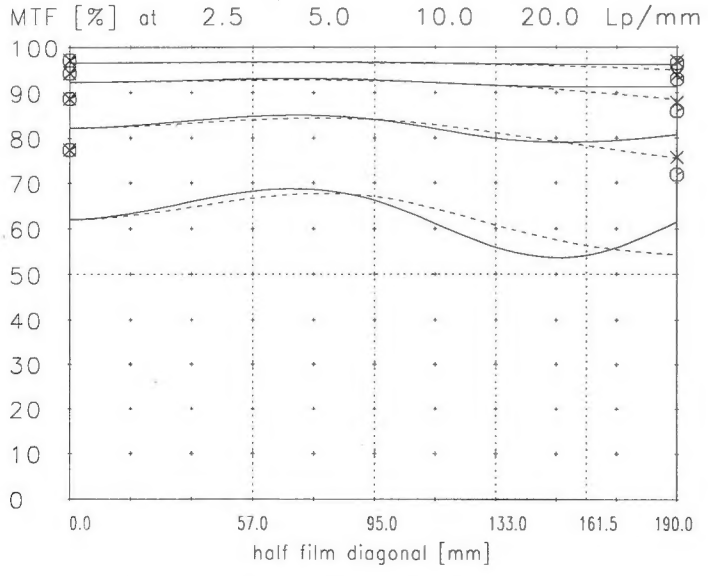
RODENSTOCK

# Rodagon-G 480 mm f/8.4

MTF at ratio 20x f/ 8.4




MTF at ratio 20x f/ 16

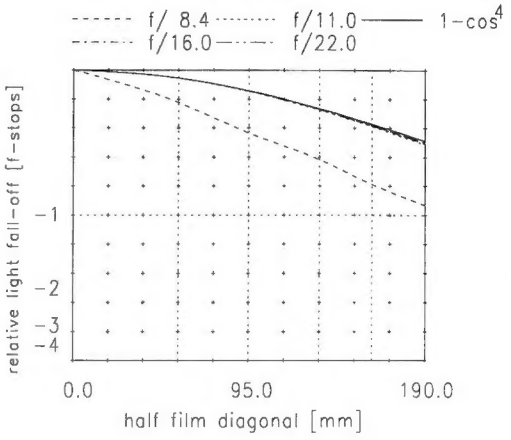



sagittal, × Diffraction limited value

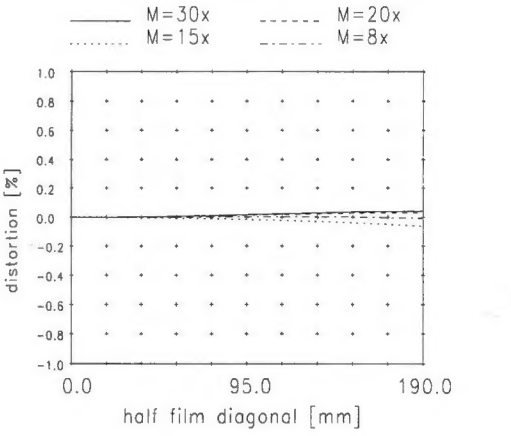
meridional, ⊖ Diffraction limited value

Named frequencies [line pairs/mm] in modular transfer function (MTF) as well as diagrams of relative light fall-off, distortion and longitudinal color aberration refer to film plane.

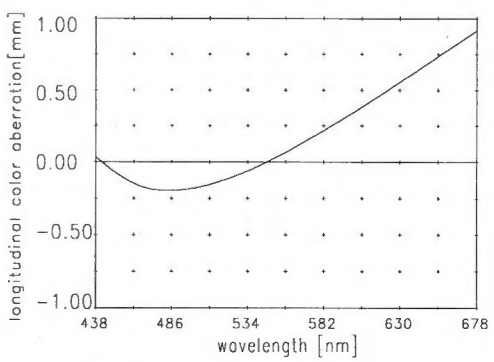
relative light fall-off at ratio 20x




Distortion at ratio 30x to 8x




Longitudinal color aberration at ratio 20x




**Rodenstock Präzisionsoptik GmbH** · Photo Optics Division
Isartalstr. 43 · D-80469 München · Germany · Phone +49(0)89/7202-673 · Fax +49(0)89/7202-164

8/96 9543 512 2512 – 9342866 Printed in Germany by Humbach & Nemazal GmbH Pfaffenhofen